



Biomass, Nutrient and Energy Content of Southeastern Wetland Hardwood Forests

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BIOMASS, NUTRIENT AND ENERGY CONTENT
OF SOUTHEASTERN WETLAND HARDWOOD FORESTS

By

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INTRODUCTION

Southeastern bottomland hardwood forests are located primarily on the Atlantic and Gulf Coastal Plain and the Mississippi River floodplain. The term "bottomland hardwoods" describes the mixed hardwood or hardwood-cypress associations occurring on soils that are saturated or inundated for portions of most years. Southeastern bottomland hardwood forests comprise approximately 31.8 million acres, with Virginia, North Carolina and South Carolina, Georgia and Florida comprising 42% of the total (Langdon, et al., 1981). These forests vary from high-quality timber to stands showing undesirable stocking, quality and species composition. Stand structure reflects a history of high-grading, agricultural use, grazing and fire, in addition to the differing shade tolerances and growth rates among species (Smith and Linnartz, 1980; Kellison, et al., 1981).

Low-quality hardwoods have gained increased attention as a potential fuel and fiber alternative because of increased fossil fuel prices, technological advances in hardwood fiber utilization in paper production, and low hardwood prices relative to softwood. Present-day trends for hardwoods indicate increasingly intensive management and utilization regimes aimed at maximizing growth and yield. Biomass yields from individual trees may be increased 10 to 65% by whole-tree removal (Clark, 1978).

Changing utilization patterns create the need to estimate total tree production on a weight-per-acre basis rather than the conventional volume estimates used for stem harvests. Further, nutrient content data for the various stand components, in conjunction with biotic and abiotic nutrient inputs, can aid scientists in evaluating the risk of site degradation and need for fertilizer amendments under intensive harvesting regimes. Also, potential energy yields

of low-quality bottomland hardwoods may provide the economic incentive to regenerate to young, fast-growing stands of more desirable structure and species composition.

The objective of this report is to summarize biomass, nutrient and energy data collected over the past four years for a variety of different-aged southeastern bottomland hardwood forest site types. These data were collected as part of a cooperative study between the N. C. State Hardwood Research Cooperative and the U. S. Forest Service, and most plots were located on industrial lands. Similar data are being collected for other regions of the South and should contribute to better understanding and management of southern hardwood forests.

STUDY AREA

Study plots were established in mixed, even-aged hardwood stands on the Atlantic and Gulf Coastal Plains. Plots were located in fully stocked stands by age class (10, 20, 40 and 60 years) and site type: (1) Bottomland--floodplain areas adjacent to stream drainages, predominantly of loam or silt loam soils; (2) wet flats--broad, interstream areas with poorly drained, nonalluvial soils; and (3) swamps--including peat and muck swamps which are characterized by organic matter accumulations and very poor internal soil drainage. Two plots were randomly located in each of the twelve site type-age class combinations except that three plots were located in the 40-year-old bottomland category (Table 1). These sites support stands which make up the largest proportion of commercial hardwoods on the Atlantic and Gulf Coastal Plains (Figure 1).

MATERIALS AND METHODS

Randomly located concentric 0.05- and 0.10-acre (ac) circular plots were established at 25 locations from 1978 to 1982 (Figure 2). Vegetation and soil

~~Plot #~~ ~~in field & data set~~

Table 1. Distribution of 25 one-tenth-acre biomass plots on the Atlantic and Gulf Coastal Plain by age, site type, county, state and cooperator

| <u>Plot no</u> | <u>Age</u> | <u>Bottomland</u> | <u>Plot no</u> | <u>Wet Flat</u> | <u>Plot no</u> | <u>Swamp</u> |
|--------------------|-------------------------|-------------------|--------------------|-------------------------|--------------------|-------------------------|
| 16 2 | Sumter, AL | | 20 10 | Duval, FL | 21 18 | Columbus, NC |
| 10 | American Can Co. | | | Container Corp. | | Georgia-Pacific Corp. |
| 18 2 | Bertie, NC | | 29 17 | St. Johns, FL | 3 19 | Florence, SC |
| | Georgia-Pacific Corp. | | | Container Corp. | | Georgia-Pacific Corp. |
| 10 2 | Warren, MS | | 19 12 | Taylor, FL | 25 20 | Nassau, FL |
| 40 3 | International Paper Co. | | | Buckeye Cellulose Corp. | | ITT Rayonier, Inc. |
| 20 13 | Sumter, AL | | 22 13 | Dorchester, SC | 26 24 | Glynn, GA |
| | American Can Co. | | | Westvaco Corp. | | Brunswick Pulp Land Co. |
| 1 2 | Dallas, AL | | 17 14 | Taylor, FL | 22 1 | Hertford, NC |
| | Hammermill Paper Co. | | | Buckeye Cellulose Corp. | | Union Camp Corp. |
| 11 8 | Southampton, VA | | 9 15 | Washington, AL | 25 23 | Craven, NC |
| 10 7 | Union Camp Corp. | | | Scott Paper Co. | | Weyerhaeuser Co. |
| | Marion, SC | | | | | |
| | International Paper Co. | | | | | |
| | | | 6 16 | Craven, NC | 6 24 | Taylor, FL |
| | | | | Weyerhaeuser Co. | | Buckeye Cellulose Corp. |
| 60 14 | Escambia, FL | | 23 17 | Jasper, SC | 22 25 | George, MS |
| | St. Regis Corporation | | | Continental Forest Ind. | | Masonite Corp. |

1/ Plot number corresponds to plot location in Figure 1.

~~Plot # circled are included in stem tree data~~

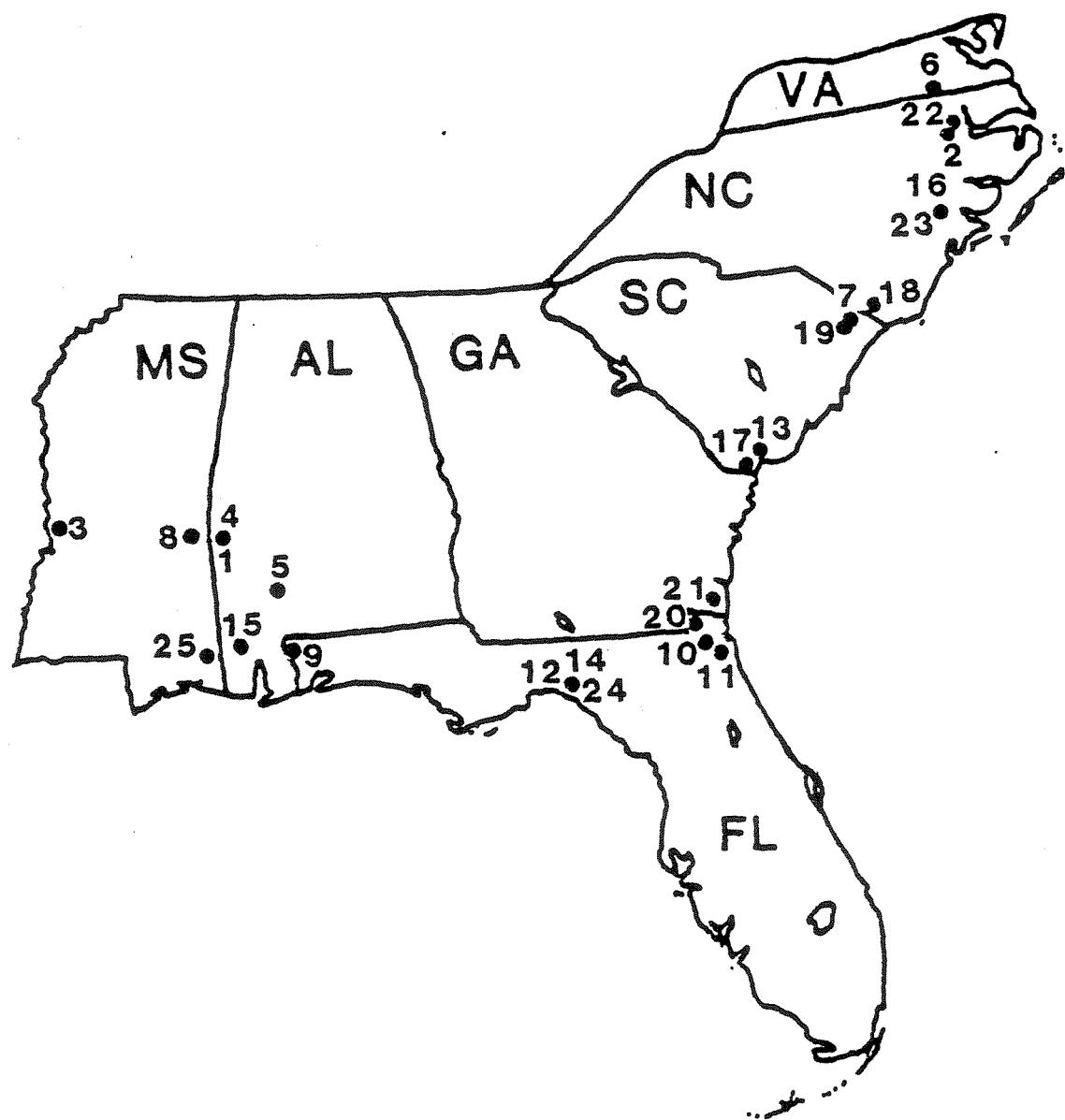


Figure 1. Location of Atlantic and Gulf Coastal Plain river bottom,
wet flat and swamp forest study plots

were sampled in late summer or early fall to minimize variation in moisture content and nutrient concentrations (Bowersox and Ward, 1977). All saplings (1.0 - 4.9 in. DBH) on the 0.05-ac and all pulpwood and sawtimber trees (\geq 5.0 in. DBH) on the 0.10-ac plots were cut. Green weight of stems, branches and foliage were determined for all trees and stem and branch disks, and foliage subsamples were taken for determination of dry weight (Figures 3-4). Disk and foliage subsamples for nutrient and energy analyses were selected from a maximum of three trees per 1.0-in. diameter class per species on each plot. Individual trees were subsampled systematically to represent bole, branch and foliage components according to the procedure described by Messina and coworkers (1983) and which generally followed the dimension analysis technique of Whittaker and Woodwell (1968).

Trees, shrubs and vines greater than 3-ft. tall and less than 1.0-in. DBH were sampled on four randomly located 6.6-x-16.4-ft. subplots, one per quadrant as determined by random azimuths from plot center (Figure 2). The material was weighed and analyzed by species, with no attempt to segregate tissue types. The segment of the stand referred to as "subordinate vegetation," less than 3 feet tall, was sampled on two randomly established line transects of twenty-five 1.0-x-2.0-ft. subplots, spaced at 3-foot intervals along each line originating from plot center (Figure 2). The plants, regardless of species, were grouped into four general vegetation classes--woody plants, grasses and sedges, vines, and annual and perennial forbs.

The forest floor was sampled, using four 1.0-ft² metal frames, with one frame randomly located per quadrant. The material was separated into three layers: L (recognizable leaves, twigs, bark, etc.), F (fragmented, partly decomposed material), and H (humus). Twenty-four randomly located soil cores (six per quadrant) were collected on each plot with a 1.0-in. diameter probe.

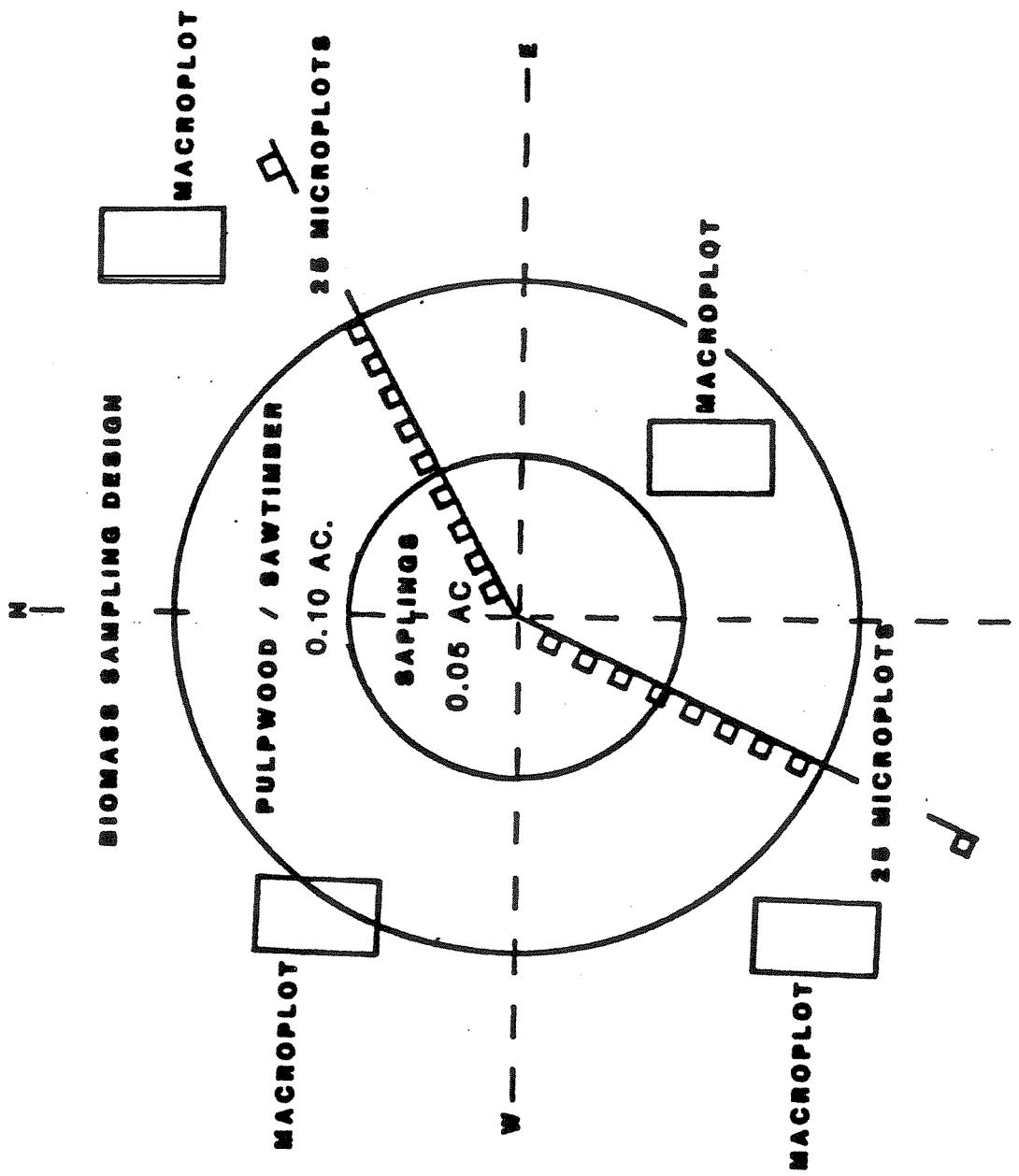


Figure 2. Forest, shrub and ground cover sampling design used for bottomland hardwood stands on the Atlantic and Gulf Coastal Plain

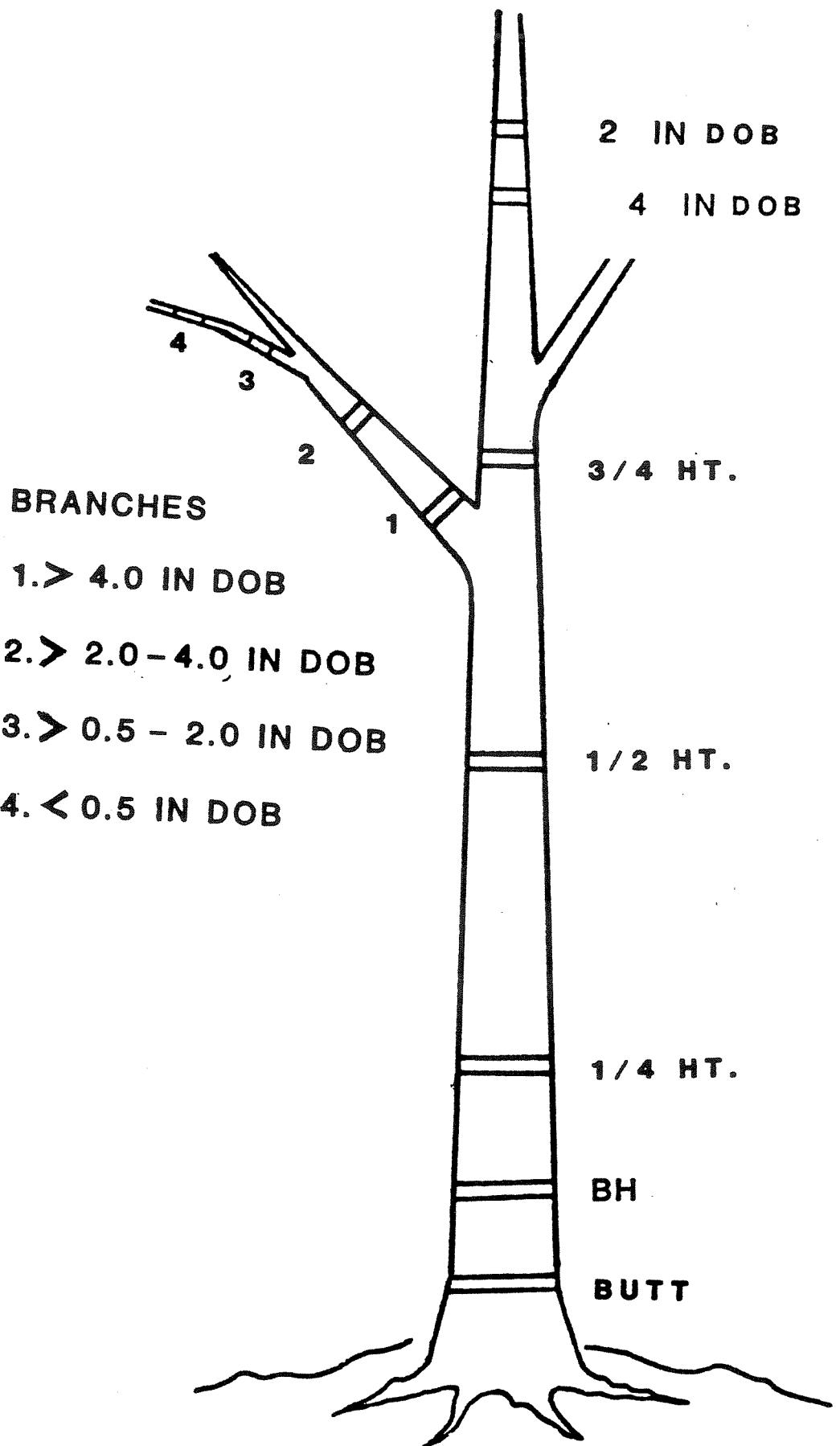


Figure 3. Pulpwood and sawtimber sampling scheme

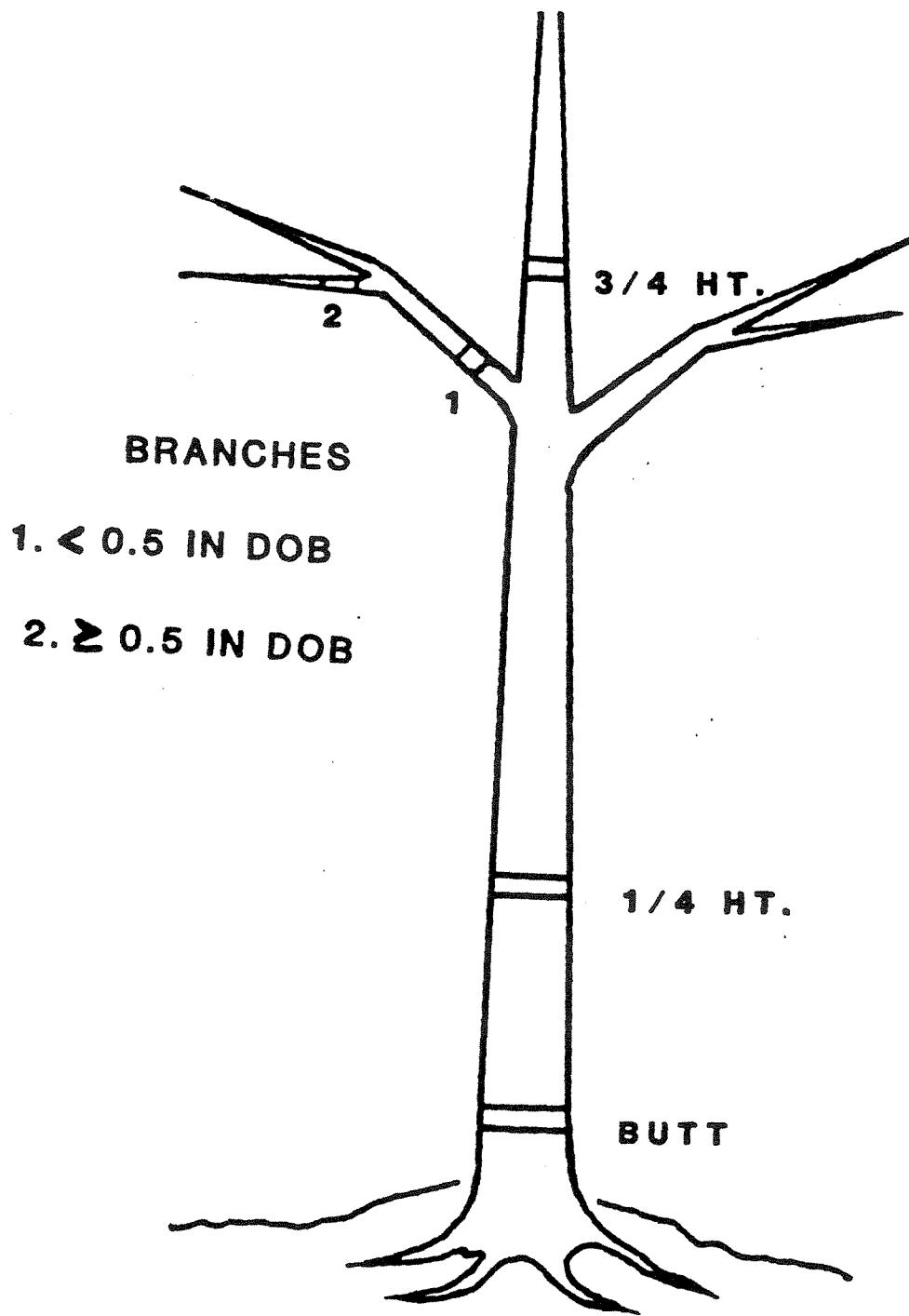


Figure 4. Sapling sampling scheme

Each core was separated by depth (0-4, 4-8, 8-12 in.) and was composited by plot. From the composited samples, two subsamples from each depth were separated for routine chemical and particle-size analysis.

Laboratory analyses followed standard procedures, with all plant and forest floor samples dried to constant weight at 158° F. Samples were ground in a Wiley Mill fitted with a 20-mesh stainless steel screen. Total nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), and magnesium (Mg) were measured following block digestion in a sulfuric acid-hydrogen peroxide mixture. Nitrogen and P were determined colorimetrically on an AutoAnalyzer as the ammonia salicylate and phosphomolybdenum complexes, respectively; K, Ca and Mg were determined by atomic absorption spectrophotometry. All tissue samples were analyzed in the soils laboratory of the Department of Forestry at North Carolina State University, and soil samples were analyzed through the routine procedures of the North Carolina Department of Agriculture, Agronomic Division. Soil chemical analysis was performed for available nutrient forms. Because there is no reliable index of availability for soil nitrogen, it was omitted from the analyses.

Higher heating values (BTU's/lb. dry weight) were determined, using an abiatic oxygen bomb calorimeter. Higher heating content was determined by multiplying the average higher heating value of a tissue component for a species by its biomass.

RESULTS AND DISCUSSION

This paper contains four tables for each of the site types sampled and are labeled by numbers followed by letter subscripts: b--bottomland, w--wet flat, and s--swamp. These tables summarize the biomass, nutrient and energy contents of the stands sampled on a per-acre and per-square-foot-of-basal-area basis.

For each site type, the average dimensions measured for saplings (1.0 to 4.9 in. DBH) and overstory trees (trees \geq 5.0 in. DBH) by age class are shown in Table 1. Table 1 also shows the average basal area and number of trees per acre by age class. Table 2 shows the frequency of species in decreasing order by the percent of basal area each comprises for overstory and sapling trees.

Table 3 for each site type shows the average green and dry weights, nutrient (N, P, K, Ca, Mg) content and higher heating values of overstory components (foliage, branches and bole), saplings, subordinate vegetation, forest floor, and soil for each age class sampled. Table 4 for each site type contains weight, nutrient and energy content per square foot of basal area. The higher heating values in Tables 3 and 4 for each site type are the BTU's per dry pound expressed on a per-acre or square-foot-of-basal-area basis. If completely dry, 100% of the energy released during combustion is theoretically available for heating. However, as wood moisture content increases, a portion of the energy is used to drive the endothermic phase change of liquid water to steam; thus the net available heat is reduced. This can be adjusted for by using the following equation:

$$\text{Available energy value} = \text{higher heating value} \times (1 - \text{moisture content of biomass fuel on a wet-weight basis})$$

The reported yields per acre are for fully stocked, vigorously growing bottomland hardwood stands and will overestimate biomass, nutrient and energy yields of understocked stands. However, rough biomass, nutrient and energy estimates of specific stands can be made, using the yields per square foot of basal area values shown in Table 4. Basal area values used to calculate per-square-foot values correspond to the respective values for each stand component, e. g., saplings, overstory or total. Species and species group biomass equations have been developed, based on the trees sampled on these

plots, and are available (Clark, et al., 1984). Applying these biomass equations to cruise data and using the mean nutrient and energy estimates will enable accurate biomass, nutrient and energy estimates to be attained for any stand.

CONCLUSIONS

The tables in this report contain the most detailed biomass, nutrient and energy information available for southern hardwoods on bottomland, wet flat and swamp site types. They are the result of detailed measurements of standing and cut trees over a wide geographic area. There is considerable variation in the measured parameters among site types and age classes within site types. However, we feel these tables contain realistic averages for fully stocked stands for the site types and age classes sampled. By using Table 4 for a given site type, estimates can be made for stands with variable stocking levels or stands having different proportions of sapling and overstory tree components. Also, by using individual species equations for weight and volume (Clark, et al., 1984), estimates can be made for stands with any combination of species. Nutrient and energy estimating equations are being developed by the N. C. State Hardwood Research Cooperative and will be available in the near future.

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Table 1b Average DBH, total height, basal area, and number of trees per acre for Coastal Plain bottomland sites, by stand age and tree size class

| Age | Average DBH | | | Average Total Height | | | Basal Area/Acre | | | Number Trees/Acre (number) |
|-----|--------------|-----------------------------------|-----------------------------|----------------------|--------------------|----------------|-----------------|---------------------------|----------------|-------------------------------|
| | All Trees | Saplings (inches) ¹ | Over- Story ² | All Trees | Saplings (feet) | Over- Story | All Trees | Saplings (square feet) | Over- Story | |
| 10 | 1.8 | 1.8 | - | 25 | 25 | - | 57 | 57 | - | 2850 |
| 20 | 5.7 | 2.8 | 6.7 | 56 | 35 | 62 | 151 | 37 | 114 | 1160 |
| 40 | 7.1 | 2.5 | 8.2 | 61 | 29 | 69 | 153 | 15 | 138 | 703 |
| 60 | 7.9 | 3.2 | 9.1 | 65 | 37 | 73 | 134 | 20 | 114 | 525 |
| | | | | | | | | | | 300 |
| | | | | | | | | | | 225 |

1/Trees 1.0 to 4.9 inches DBH

2/Trees \geq 5.0 inches DBH

Table 2b Percent species basal area over all age classes on bottomland sites

| Species | Percent | | Percent |
|-----------------------------------|----------|---------|---------|
| | Species | Percent | |
| Overstory (Pulpwood/Sawtimber) | Saplings | | |
| Sweetgum | | 50 | 33 |
| Water Oak | | 16 | 16 |
| Green Ash | | 10 | 8 |
| Hickory | | 8 | 7 |
| Cottonwood | | 3 | 7 |
| Sycamore | | 3 | 6 |
| Others | | 10 | 6 |
| Total | | | 100 |

Table 3b Average green and dry weight, nutrient content and higher heating values per acre of site pools in the 10-, 20-, 40- and 60-year-old bottomland site types

| Component | Weight Green Dry (tons/acre) | Nutrient Contents | | | Higher Heating Values (BTU's/acre X 10 ⁶) |
|------------------------|---------------------------------------|-------------------|-------|------|---|
| | | N | P | K | |
| <u>Age 10</u> | | | | | |
| Overstory ¹ | - | - | - | - | - |
| Foliage | - | - | - | - | - |
| Crown ² | - | - | - | - | - |
| Bole ³ | - | - | - | - | - |
| Saplings ⁴ | 35.1 | 19.0 | 125.8 | 20.5 | 98.1 |
| Aboveground | | | | | 124.9 |
| Tree Total | 35.1 | 19.0 | 125.8 | 20.5 | 98.1 |
| Subordinate | | | | | 124.9 |
| Vegetation | 3.1 | 1.4 | 16.4 | 2.9 | 8.6 |
| Forest Floor | - | 4.7 | 114.8 | 12.0 | 52.9 |
| Soil ⁵ | - | - | - | 13.4 | 56.2 |
| Aboveground | | | | | 1774.2 |
| Tree Total | 138.5 | 64.2 | 182.0 | 29.0 | 167.9 |
| Subordinate | | | | | 352.8 |
| Vegetation | 1.2 | 0.4 | 9.8 | 0.9 | 3.6 |
| Forest Floor | | 0.9 | 18.1 | 2.0 | 5.1 |
| Soil ⁵ | - | - | - | 74.9 | 279.2 |
| Aboveground | | | | | 2582.3 |
| Tree Total | | | | | 296.1 |
| <u>Age 20</u> | | | | | |
| Overstory ¹ | 112.9 | 52.0 | 144.2 | 23.6 | 136.4 |
| Foliage | 2.4 | 0.8 | 22.3 | 5.4 | 13.4 |
| Crown ² | 26.3 | 12.4 | 49.0 | 7.2 | 35.4 |
| Bole ³ | 84.2 | 38.8 | 72.9 | 11.0 | 87.6 |
| Saplings ⁴ | 25.6 | 12.2 | 37.8 | 5.4 | 31.5 |
| Aboveground | | | | | 92.7 |
| Tree Total | | | | | 11.7 |
| Subordinate | | | | | |
| Vegetation | | | | | |
| Forest Floor | | | | | |
| Soil ⁵ | | | | | |
| Aboveground | | | | | |
| Tree Total | | | | | |
| <u>Age 30</u> | | | | | |
| Overstory ¹ | 102.9 | 48.0 | 134.2 | 22.6 | 126.4 |
| Foliage | 2.4 | 0.8 | 21.3 | 5.4 | 13.4 |
| Crown ² | 26.3 | 12.4 | 47.0 | 7.2 | 35.4 |
| Bole ³ | 84.2 | 38.8 | 71.9 | 11.0 | 87.6 |
| Saplings ⁴ | 25.6 | 12.2 | 37.8 | 5.4 | 31.5 |
| Aboveground | | | | | 92.7 |
| Tree Total | | | | | 11.7 |
| Subordinate | | | | | |
| Vegetation | | | | | |
| Forest Floor | | | | | |
| Soil ⁵ | | | | | |
| Aboveground | | | | | |
| Tree Total | | | | | |
| <u>Age 40</u> | | | | | |
| Overstory ¹ | 92.9 | 44.0 | 124.2 | 21.6 | 116.4 |
| Foliage | 2.4 | 0.8 | 20.3 | 5.4 | 12.4 |
| Crown ² | 26.3 | 12.4 | 45.0 | 7.2 | 35.4 |
| Bole ³ | 84.2 | 38.8 | 70.9 | 11.0 | 87.6 |
| Saplings ⁴ | 25.6 | 12.2 | 37.8 | 5.4 | 31.5 |
| Aboveground | | | | | 92.7 |
| Tree Total | | | | | 11.7 |
| Subordinate | | | | | |
| Vegetation | | | | | |
| Forest Floor | | | | | |
| Soil ⁵ | | | | | |
| Aboveground | | | | | |
| Tree Total | | | | | |
| <u>Age 50</u> | | | | | |
| Overstory ¹ | 82.9 | 40.0 | 114.2 | 20.6 | 106.4 |
| Foliage | 2.4 | 0.8 | 18.3 | 5.4 | 12.4 |
| Crown ² | 26.3 | 12.4 | 43.0 | 7.2 | 35.4 |
| Bole ³ | 84.2 | 38.8 | 70.9 | 11.0 | 87.6 |
| Saplings ⁴ | 25.6 | 12.2 | 37.8 | 5.4 | 31.5 |
| Aboveground | | | | | 92.7 |
| Tree Total | | | | | 11.7 |
| Subordinate | | | | | |
| Vegetation | | | | | |
| Forest Floor | | | | | |
| Soil ⁵ | | | | | |
| Aboveground | | | | | |
| Tree Total | | | | | |
| <u>Age 60</u> | | | | | |
| Overstory ¹ | 72.9 | 36.0 | 104.2 | 19.6 | 96.4 |
| Foliage | 2.4 | 0.8 | 16.3 | 5.4 | 12.4 |
| Crown ² | 26.3 | 12.4 | 41.0 | 7.2 | 35.4 |
| Bole ³ | 84.2 | 38.8 | 70.9 | 11.0 | 87.6 |
| Saplings ⁴ | 25.6 | 12.2 | 37.8 | 5.4 | 31.5 |
| Aboveground | | | | | 92.7 |
| Tree Total | | | | | 11.7 |
| Subordinate | | | | | |
| Vegetation | | | | | |
| Forest Floor | | | | | |
| Soil ⁵ | | | | | |
| Aboveground | | | | | |
| Tree Total | | | | | |

1/ Trees ≥ 5.0 inches DBH

2/ All branches plus stem above 4" DOB top

3/ Bole from stump to 4" DOB top

4/ Trees 1.0 to 4.9 inches DBH

5/ Available P and exchangeable K, Ca and Mg to 12" depth

Table 3b (continued)

| Component | Weight Green Dry (tons/acre) | Nutrient Contents (lbs./acre) | | | | Higher Heating Values (BTU's/acre X 10 ⁶) |
|--|---------------------------------------|----------------------------------|-------|------|-------|---|
| | | P | N | K | Ca | |
| <u>Age 40</u> | | | | | | |
| Oversstory ¹ | 156.1 | 85.8 | 328.3 | 50.8 | 263.0 | 315.7 |
| Foliage | 4.7 | 1.9 | 74.4 | 6.6 | 32.4 | 57.5 |
| Crown ² | 35.3 | 19.8 | 111.6 | 18.4 | 81.2 | 11.8 |
| Bole ³ | 116.1 | 64.1 | 142.3 | 25.8 | 149.4 | 26.1 |
| Saplings ⁴ | 11.5 | 6.1 | 27.2 | 4.1 | 17.7 | 10.9 |
| Aboveground | | | | | | |
| Tree Total | 167.6 | 91.9 | 355.5 | 54.9 | 280.7 | 326.6 |
| Subordinate | | | | | | |
| Vegetation | 3.1 | 1.3 | 17.0 | 2.7 | 17.0 | 5.4 |
| Forest Floor | - | 2.2 | 50.0 | 4.5 | 19.6 | 33.0 |
| Soil ⁵ | - | - | - | 17.8 | 106.2 | 1989.2 |
| <u>Age 60</u> | | | | | | |
| Oversstory ¹ | 172.9 | 93.8 | 344.9 | 46.1 | 321.4 | 889.2 |
| Foliage | 4.8 | 2.2 | 65.2 | 4.9 | 31.5 | 42.0 |
| Crown ² | 30.3 | 17.3 | 111.1 | 21.3 | 79.6 | 220.2 |
| Bole ³ | 137.8 | 74.3 | 168.6 | 19.9 | 210.3 | 665.5 |
| Saplings ⁴ | 14.7 | 8.4 | 38.0 | 4.2 | 28.5 | 74.9 |
| Aboveground | | | | | | |
| Tree Total | 187.6 | 102.2 | 382.9 | 50.3 | 349.9 | 964.8 |
| Subordinate | | | | | | |
| Vegetation | 1.6 | 0.7 | 8.9 | 1.8 | 5.4 | 12.5 |
| Forest Floor | - | 3.3 | 52.6 | 5.4 | 15.2 | 81.2 |
| Soil ⁵ | - | - | - | 18.7 | 151.6 | 1459.3 |
| <u>Age 100</u> | | | | | | |
| 1/ Trees \geq 5.0 inches DBH | | | | | | |
| 2/ All branches plus stem above 4" DOB top | | | | | | |
| 3/ Bole from stump to 4" DOB top | | | | | | |
| <u>4/ Trees 1.0 to 4.9 inches DBH</u> | | | | | | |
| <u>5/ Available P and exchangeable K, Ca and Mg to 12" depth</u> | | | | | | |

Table 4b Average green and dry weight, nutrient content and higher heating values per square foot of bassal area of stand components in the 10-, 20-, 40- and 60-year-old bottomland site types

| Component | Weight Green Dry (tons/sq.ft.) | Nutrient Contents (lbs./sq.ft.) | | | Higher Heating Values (BTU's X 10 ⁶ /sq.ft.) |
|--|---|------------------------------------|------|------|---|
| | | P | K | Ca | |
| <u>Age 10</u> | | | | | |
| Overstory ¹ | - | - | - | - | - |
| Foliage ² | - | - | - | - | - |
| Crown ² | - | - | - | - | - |
| Bole ³ | - | - | - | - | - |
| Saplings ⁴ | 0.62 | 0.33 | 2.20 | 0.36 | 5.6 |
| Total 5 | 0.62 | 0.33 | 2.20 | 0.36 | 5.6 |
| <u>Age 20</u> | | | | | |
| Overstory ¹ | 0.99 | 0.46 | 1.26 | 0.21 | 2.28 |
| Foliage | 0.02 | 0.01 | 0.20 | 0.05 | 0.15 |
| Crown ² | 0.23 | 0.11 | 0.43 | 0.06 | 0.31 |
| Bole ³ | 0.74 | 0.34 | 0.64 | 0.10 | 0.77 |
| Saplings ⁴ | 0.69 | 0.33 | 1.02 | 0.15 | 1.36 |
| Total 5 | 0.92 | 0.43 | 1.21 | 0.19 | 2.51 |
| Total 5 | 0.92 | 0.43 | 1.11 | 0.11 | 2.34 |
| Total 5 | 0.92 | 0.43 | 1.11 | 0.11 | 2.34 |
| 4/ Trees 1.0 to 4.9 inches DBH | | | | | |
| 5/ Trees \geq 1.0 inch DBH | | | | | |
| 1/ Trees \geq 5.0 inches DBH | | | | | |
| 2/ All branches plus stem above 4" DOB top | | | | | |
| 3/ Bole from stump to 4" DOB top | | | | | |

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Table 4 b (continued)

Table 1_w Average DBH, total height, basal area and number of trees per acre for Coastal Plain wet flat sites, by stand age and tree size class

| Age | Average DBH | | | Average Total Height | | | Basal Area/Acre | | | Number Trees/Acre | | |
|-----|-------------|-----------------------------|-----------|----------------------|-------|-----------|-----------------|-------|-----------|-----------------------------|-----------|-------|
| | All Trees | Over- ₂ Saplings | All Trees | Saplings | Story | All Trees | Saplings | Story | All Trees | Over- ₂ Saplings | All Trees | Story |
| | (inches) | | | (feet) | | | (square feet) | | | (number) | | |
| 10 | 1.8 | 1.8 | - | 22 | 22 | - | 48 | 48 | - | 2350 | 2350 | - |
| 20 | 2.8 | 2.1 | 6.7 | 33 | 30 | 52 | 84 | 66 | 18 | 2295 | 2225 | 70 |
| 40 | 7.0 | 1.5 | 8.7 | 54 | 18 | 66 | 113 | 5 | 108 | 610 | 375 | 235 |
| 60 | 8.9 | 3.0 | 10.0 | 76 | 34 | 84 | 175 | 14 | 161 | 510 | 250 | 260 |

1/Trees 1.0 to 4.9 inches DBH

2/Trees \geq 5.0 inches DBH

Table 2_w Percent species basal area over all age classes on wet flat sites

| Species | Percent | |
|---------------------|-----------------------------------|--------------|
| | Overstory (Pulpwood/Sawtimber) | Saplings |
| Sweetgum | 51 | Water Oak |
| Green Ash | 27 | Water Tupelo |
| Water Oak | 10 | Red Maple |
| Black Gum (lowland) | 3 | Sweetgum |
| Laurel Oak | 3 | Hickory |
| Red Maple | 3 | Laurel Oak |
| Others | 3 | Green Ash |
| | | Others |
| Total | 100 | 100 |

Table 3_w Average green and dry weight, nutrient content, and higher heating values per acre of site pools
in 10-, 20-, 40- and 60-year-old wet flat site types

| Component | Weight | | | | Nutrient Contents | | | | (BTU's/acre X 10 ⁶) |
|--|--------|------|-------|------|-------------------|--------|-------|-----------------------|---------------------------------|
| | Green | Dry | N | P | K | Ca | Mg | Higher Heating Values | |
| | | | | | Age 10 | | | | |
| Overstory ¹ | - | - | - | - | - | - | - | - | - |
| Foliage | - | - | - | - | - | - | - | - | - |
| Crown ² | - | - | - | - | - | - | - | - | - |
| Bole ³ | - | - | - | - | - | - | - | - | - |
| Saplings ⁴ | 37.8 | 19.5 | 126.7 | 9.8 | 67.8 | 151.6 | 24.1 | 318.1 | |
| Aboveground | | | | | | | | | |
| Tree Total | 37.8 | 19.5 | 126.7 | 9.8 | 67.8 | 151.6 | 24.1 | 318.1 | |
| Subordinate | | | | | | | | | |
| Vegetation | 4.9 | 2.2 | 12.5 | 1.8 | 13.4 | 7.1 | 3.6 | 26.5 | |
| Forest Floor | - | 5.0 | 135.6 | 7.2 | 8.0 | 162.3 | 19.6 | 88.8 | |
| Soil ⁵ | - | - | - | 10.7 | 65.1 | 1957.1 | 281.0 | - | |
| Aboveground | | | | | | | | | |
| Tree Total | 70.3 | 38.8 | 196.1 | 29.9 | 85.7 | 297.3 | 37.9 | 638.8 | |
| Subordinate | | | | | | | | | |
| Vegetation | 2.3 | 1.0 | 9.8 | 1.8 | 4.5 | 14.3 | 2.7 | 16.4 | |
| Forest Floor | - | 3.3 | 88.3 | 8.0 | 5.4 | 67.8 | 5.4 | 63.6 | |
| Soil ⁵ | - | - | - | 89.2 | 52.6 | 2129.2 | 91.0 | - | |
| 1/ Trees \geq 5.0 inches DBH | | | | | | | | | |
| 2/ All branches plus stem above 4" DOB top | | | | | | | | | |
| 3/ Bole from stump to 4" DOB top | | | | | | | | | |

Table 3_w(continued)

| Component | Weight | | | Nutrient Contents | | | Higher Heating Values (BTU's/acre X 10 ⁶) |
|------------------------|-------------|-------|-------|-------------------|-------|--------|---|
| | Green | Dry | N | P | K | Ca | |
| | (tons/acre) | | | (lbs./acre) | | | |
| Overstory ¹ | 103.9 | 62.9 | 218.9 | 40.5 | 140.2 | 430.8 | 46.2 |
| Foliage | 3.2 | 1.9 | 54.6 | 5.6 | 15.1 | 32.0 | 8.5 |
| Crown ² | 22.1 | 13.3 | 38.0 | 8.4 | 19.0 | 56.6 | 9.3 |
| Bole ³ | 78.6 | 47.7 | 126.3 | 26.5 | 106.1 | 342.2 | 28.4 |
| Saplings ⁴ | 3.0 | 1.6 | 14.3 | 1.9 | 6.7 | 19.0 | 1.9 |
| Aboveground | | | | | | | 25.7 |
| Tree Total | 106.9 | 64.5 | 233.2 | 42.4 | 146.9 | 449.8 | 48.1 |
| Subordinate | | | | | | | 1078.3 |
| Vegetation | 1.2 | 0.5 | 16.1 | 2.7 | 12.5 | 17.0 | 2.7 |
| Forest Floor | - | 3.0 | 30.3 | 5.4 | 20.5 | 12.9 | 7.1 |
| Soil ⁵ | - | - | - | 48.2 | 131.1 | 1663.2 | 205.2 |
| Age 40 | | | | | | | |
| Overstory ¹ | 235.5 | 119.8 | 331.2 | 29.2 | 127.3 | 299.3 | 52.3 |
| Foliage | 4.1 | 1.6 | 48.5 | 2.9 | 13.3 | 22.8 | 6.7 |
| Crown ² | 44.1 | 23.0 | 59.2 | 8.4 | 35.5 | 87.8 | 13.8 |
| Bole ³ | 187.2 | 95.0 | 223.5 | 17.9 | 78.5 | 188.7 | 31.8 |
| Saplings ⁴ | 9.2 | 5.0 | 17.0 | 2.1 | 9.6 | 23.4 | 2.1 |
| Aboveground | | | | | | | 76.0 |
| Tree Total | 244.7 | 124.8 | 348.2 | 31.3 | 136.9 | 302.7 | 54.4 |
| Subordinate | | | | | | | 2075.4 |
| Vegetation | 1.0 | 0.4 | - | - | - | - | - |
| Forest Floor | - | 4.4 | 93.7 | 7.1 | 8.0 | 28.5 | 4.5 |
| Soil ⁵ | - | - | - | 15.2 | 66.0 | 414.8 | 108.8 |
| Age 60 | | | | | | | |
| Overstory ¹ | 235.5 | 119.8 | 331.2 | 29.2 | 127.3 | 299.3 | 52.3 |
| Foliage | 4.1 | 1.6 | 48.5 | 2.9 | 13.3 | 22.8 | 6.7 |
| Crown ² | 44.1 | 23.0 | 59.2 | 8.4 | 35.5 | 87.8 | 13.8 |
| Bole ³ | 187.2 | 95.0 | 223.5 | 17.9 | 78.5 | 188.7 | 31.8 |
| Saplings ⁴ | 9.2 | 5.0 | 17.0 | 2.1 | 9.6 | 23.4 | 2.1 |
| Aboveground | | | | | | | 76.0 |
| Tree Total | 244.7 | 124.8 | 348.2 | 31.3 | 136.9 | 302.7 | 54.4 |
| Subordinate | | | | | | | 2075.4 |
| Vegetation | 1.0 | 0.4 | - | - | - | - | - |
| Forest Floor | - | 4.4 | 93.7 | 7.1 | 8.0 | 28.5 | 4.5 |
| Soil ⁵ | - | - | - | 15.2 | 66.0 | 414.8 | 108.8 |

¹/ Trees \geq 5.0 inches DBH²/ All branches plus stem above 4" DOB top³/ Bole from stump to 4" DOB top⁴/ Trees 1.0 to 4.9 inches DBH⁵/ Available P and exchangeable K, Ca and Mg to 12" depth

Table 4_w Average green and dry weight, nutrient content and higher heating values per square foot of basal area of stand components in the 10-, 20-, 40- and 60-year-old wet flat site types

| Component | Weight | | Nutrient Contents | | | MG | Higher Heating Values (BTU's X 10 ⁶ /sq.ft.) | |
|------------------------|---------------|------|-------------------|------|------|------|--|--|
| | Green | Dry | N | P | K | | | |
| | (tons/sq.ft.) | | | | | | | |
| <u>Age 10</u> | | | | | | | | |
| Overstory ¹ | - | - | - | - | - | - | - | |
| Foliage | - | - | - | - | - | - | - | |
| Crown ² | - | - | - | - | - | - | - | |
| Bole ³ | - | - | - | - | - | - | - | |
| Saplings ⁴ | 0.79 | .41 | 2.64 | 0.20 | 1.41 | 3.16 | 6.6 | |
| Total ⁵ | 0.79 | .41 | 2.64 | 0.20 | 1.41 | 3.16 | 6.6 | |
| <u>Age 20</u> | | | | | | | | |
| Overstory ¹ | 0.22 | 0.11 | 2.32 | 0.42 | 0.99 | 3.58 | 0.52 | |
| Foliage | 0.02 | 0.01 | 0.88 | 0.08 | 0.20 | 0.68 | 0.13 | |
| Crown ² | 0.06 | 0.04 | 0.74 | 0.17 | 0.30 | 2.08 | 0.17 | |
| Bole ³ | 0.14 | 0.07 | 0.69 | 0.17 | 0.49 | 0.82 | 0.22 | |
| Saplings ⁴ | 0.62 | 0.35 | 2.34 | 0.34 | 1.03 | 3.53 | 1.58 | |
| Total ⁵ | 0.84 | 0.46 | 2.33 | 0.36 | 1.02 | 3.54 | 0.45 | |
| | | | | | | | 7.6 | |

1/ Trees \geq 5.0 inches DBH

2/ All branches plus stem above 4" DOB top

3/ Bole from stump to 4" DOB top

4/ Trees 1.0 to 4.9 inches DBH

5/ Trees \geq 1.0 inches DBH

| Component | Weight Green Dry | | | Nutrient Content (lbs./sq.ft.) | | | (BTU's X 106/sq.ft.) | Higher Heating Values |
|------------------------|------------------------|------|------|-----------------------------------|------|------|----------------------|--------------------------|
| | P | N | K | Ca | Mg | | | |
| <u>Age 40</u> | | | | | | | | |
| Overstory ¹ | 0.92 | 0.56 | 2.03 | 0.38 | 1.30 | 3.99 | 0.43 | 9.7 |
| Foliage | 0.03 | 0.02 | 0.51 | 0.05 | 0.14 | 0.30 | 0.08 | 0.3 |
| Crown ² | 0.20 | 0.12 | 0.35 | 0.08 | 0.18 | 0.52 | 0.09 | 2.2 |
| Bole ³ | 0.70 | 0.42 | 1.17 | 0.25 | 0.98 | 2.17 | 0.26 | 7.2 |
| Saplings ⁴ | 0.03 | 0.01 | 2.86 | 0.38 | 1.34 | 3.80 | 0.38 | 5.1 |
| Total ⁵ | 0.95 | 0.57 | 2.06 | 0.38 | 1.30 | 3.98 | 0.43 | 9.5 |
| <u>Age 60</u> | | | | | | | | |
| Overstory ¹ | 1.35 | 0.69 | 2.06 | 0.18 | 0.79 | 1.86 | 0.32 | 12.4 |
| Foliage | 0.02 | 0.01 | 0.30 | 0.02 | 0.08 | 0.14 | 0.04 | 0.2 |
| Crown ² | 0.25 | 0.13 | 0.37 | 0.05 | 0.22 | 0.55 | 0.09 | 2.3 |
| Bole ³ | 1.07 | 0.54 | 1.39 | 0.11 | 0.49 | 1.17 | 0.20 | 9.9 |
| Saplings ⁴ | 0.05 | 0.03 | 1.21 | 0.15 | 0.69 | 1.67 | 0.15 | 5.4 |
| Total ⁵ | 1.40 | 0.71 | 1.99 | 0.18 | 0.78 | 1.73 | 0.31 | 11.9 |

1/ Trees \geq 5.0 inches DBH

2/ All branches plus stem above 4" DOB top

3/ Bole from stump to 4" DOB top

4/ Trees 1.0 to 4.9 inches DBH

5/ Trees \geq 1.0 inch DBH

Table 1 s Average DBH, total height, basal area and number of trees per acre for Coastal Plain swamp sites, by stand age and tree size class

| Age | Average DBH | | | Average Total Height | | | Basal Area/Acre | | | Number Trees/Acre | | |
|--|-------------|-----------------------|--------------------------|----------------------|----------|-------|-----------------|----------|-------|-------------------|----------|-------|
| | All Trees | Saplings ¹ | Over- ² Story | All Trees | Saplings | Story | All Trees | Saplings | Story | All Trees | Saplings | Story |
| ----- (inches) ----- (feet) ----- (square feet) ----- (number) ----- | | | | | | | | | | | | |
| 10 | 1.8 | 1.7 | 6.1 | 23 | 42 | 87 | 83 | 4 | 4495 | 4475 | 20 | |
| 20 | 2.7 | 2.0 | 6.6 | 30 | 27 | 45 | 102 | 32 | 3880 | 3750 | 130 | |
| 40 | 6.0 | 2.5 | 7.8 | 51 | 29 | 63 | 224 | 52 | 1720 | 1250 | 470 | |
| 60 | 10.4 | 3.4 | 11.2 | 72 | 40 | 75 | 292 | 13 | 279 | 570 | 370 | |

1/ Trees 1.0 to 4.9 inches DBH

2/ Trees \geq 5.0 inches DBH

Table 2 s Percent species basal area over all age classes on swamp sites

| Species | Percent | | Percent | |
|--------------|-----------------------------------|----------|------------------|-----|
| | Overstory (Pulpwood/Sawtimber) | Saplings | | |
| Black Gum | 32 | | Ash | 40 |
| Water Tupelo | 17 | | Swamp Cottonwood | 19 |
| Red Maple | 16 | | Water Tupelo | 15 |
| Sweetgum | 11 | | Black Gum | 8 |
| Pond Cypress | 5 | | Sweetgum | 7 |
| Bald Cypress | 4 | | Red Maple | 4 |
| Water Oak | 4 | | Others | 7 |
| Others | 1.1 | | | |
| Total | 100 | | Total | 100 |

Table 35 Average green and dry weight, nutrient content and higher heating values per acre of site pools in 10-, 20-, 40- and 60-year-old swamp site types

| Component | Weight Green Dry | | | | Nutrient Contents P K Ca Mg | | | | (BTU's/acre X 10 ⁶ /sq.ft.) |
|--|---|------|-------|------|---|---------|--------|-------|--|
| | (tons/acre) | | | | Age 10 | | | | |
| Overstory ¹ | 1.9 | 0.9 | 4.9 | 2.4 | 2.9 | 3.7 | 2.4 | 16.2 | |
| Foliage | 0.1 | 0. | 4.0 | 2.0 | 2.0 | 2.0 | 2.0 | 0.6 | |
| Crown ² | 0.8 | 0.5 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 3.4 | |
| Bole ³ | 1.0 | 0.4 | 0.8 | 0.4 | 0.8 | 1.6 | 0.4 | 12.2 | |
| Saplings ⁴ | 34.8 | 17.0 | 81.2 | 8.0 | 70.5 | 96.3 | 21.4 | 288.6 | |
| Aboveground | | | | | | | | | |
| Tree Total | 36.7 | 17.9 | 86.1 | 10.4 | 73.4 | 100.0 | 23.8 | 304.8 | |
| Subordinate | | | | | | | | | |
| Vegetation | 6.9 | 2.9 | 3.6 | 0.9 | 3.6 | 2.7 | 0.9 | 8.4 | |
| Forest Floor | - | 9.9 | 267.6 | 18.7 | 25.9 | 17.0 | 12.5 | 208.9 | |
| Soil ⁵ | - | - | - | 64.2 | 86.5 | 320.2 | 149.9 | - | |
| | | | | | | | | | |
| | Age 20 | | | | | | | | |
| Overstory ¹ | 24.8 | 13.4 | 51.6 | 5.2 | 25.9 | 97.9 | 16.2 | 223.1 | |
| Foliage | 1.5 | 0.6 | 16.1 | 0.8 | 3.8 | 8.4 | 3.8 | 10.8 | |
| Crown ² | 7.6 | 4.2 | 17.0 | 1.8 | 9.8 | 34.8 | 4.5 | 69.2 | |
| Bole ³ | 15.7 | 8.6 | 18.5 | 2.6 | 12.3 | 54.7 | 7.9 | 143.1 | |
| Saplings ⁴ | 60.6 | 33.4 | 156.1 | 14.4 | 81.7 | 279.1 | 28.7 | 564.3 | |
| Aboveground | | | | | | | | | |
| Tree Total | 85.4 | 46.8 | 207.7 | 19.6 | 107.6 | 377.0 | 44.9 | 787.4 | |
| Subordinate | | | | | | | | | |
| Vegetation | 4.0 | 1.7 | 8.9 | 0.9 | 4.5 | 12.5 | 1.8 | 13.5 | |
| Forest Floor | - | 12.7 | 41.9 | 2.7 | 2.7 | 0.9 | 1.8 | 171.5 | |
| Soil ⁵ | - | - | - | 8.9 | 140.0 | 12357.8 | 1251.5 | - | |
| | | | | | | | | | |
| ¹ / Trees \geq 5.0 inches DBH | ⁴ / Trees 1.0 to 4.9 inches DBH ⁵ / Available P and exchangeable K, Ca and Mg to 12" depth | | | | | | | | |
| ² / All branches plus stem above 4" DOB top | | | | | | | | | |
| ³ / Bole from stump to 4" DOB top | | | | | | | | | |

Table 3 Average green and dry weight, nutrient content and higher heating values per acre of site pools in 10-, 20-, 40- and 60-year-old swamp site types

| Component | Weight | | | Nutrient Contents | | | Higher Heating Values | |
|---|----------------------|--------------------|-------|-------------------|-------|---------|-----------------------|--|
| | Green (tons/acre) | Dry (tons/acre) | N | P | K | Ca | Mg | (BTU's/acre x 10 ⁶ /sq.ft.) |
| Age 10 | | | | | | | | |
| Overstory ¹ | 1.9 | 0.9 | 4.9 | 2.4 | 2.9 | 3.7 | 2.4 | 16.2 |
| Foliage | 0.1 | 0. | 4.0 | 2.0 | 2.0 | 2.0 | 2.0 | 0.6 |
| Crown ² | 0.8 | 0.5 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 3.4 |
| Bole ³ | 1.0 | 0.4 | 0.8 | 0.4 | 0.8 | 1.6 | 0.4 | 12.2 |
| Saplings ⁴ | 34.8 | 17.0 | 81.2 | 8.0 | 70.5 | 96.3 | 21.4 | 288.6 |
| Aboveground | | | | | | | | |
| Tree Total | 36.7 | 17.9 | 86.1 | 10.4 | 73.4 | 100.0 | 23.8 | 304.8 |
| Subordinate | | | | | | | | |
| Vegetation | 6.9 | 2.9 | 3.6 | 0.9 | 3.6 | 2.7 | 0.9 | 8.4 |
| Forest Floor | - | 9.9 | 267.6 | 18.7 | 25.9 | 17.0 | 12.5 | 208.9 |
| Soil ⁵ | - | - | - | 64.2 | 86.5 | 320.2 | 149.9 | - |
| Age 20 | | | | | | | | |
| Overstory ¹ | 24.8 | 13.4 | 51.6 | 5.2 | 25.9 | 97.9 | 16.2 | 223.1 |
| Foliage | 1.5 | 0.6 | 16.1 | 0.8 | 3.8 | 8.4 | 3.8 | 10.8 |
| Crown ² | 7.6 | 4.2 | 17.0 | 1.8 | 9.8 | 34.8 | 4.5 | 69.2 |
| Bole ³ | 15.7 | 8.6 | 18.5 | 2.6 | 12.3 | 54.7 | 7.9 | 143.1 |
| Saplings ⁴ | 60.6 | 33.4 | 156.1 | 14.4 | 81.7 | 279.1 | 28.7 | 564.3 |
| Aboveground | | | | | | | | |
| Tree Total | 85.4 | 46.8 | 207.7 | 19.6 | 107.6 | 377.0 | 44.9 | 787.4 |
| Subordinate | | | | | | | | |
| Vegetation | 4.0 | 1.7 | 8.9 | 0.9 | 4.5 | 12.5 | 1.8 | 13.5 |
| Forest Floor | - | 12.7 | 41.9 | 2.7 | 2.7 | 0.9 | 1.8 | 171.5 |
| Soil ⁵ | - | - | - | 8.9 | 140.0 | 12357.8 | 1251.5 | - |
| Age 60 | | | | | | | | |
| 1/ Trees ≥ 5.0 inches DBH | | | | | | | | |
| 2/ All branches plus stem above 4" DOB top | | | | | | | | |
| 3/ Bole from stump to 4" DOB top | | | | | | | | |
| 4/ Trees 1.0 to 4.9 inches DBH | | | | | | | | |
| 5/ Available P and exchangeable K, Ca and Mg to 12" depth | | | | | | | | |

Table 3's (continued)

| Component | Weight | | Nutrient Contents | | | Ca | Mg | Higher Heating Values (BTUs/acre X 10 ⁶ /sq.ft.) |
|------------------------|-------------|-------|-------------------|------|-------|--------|---------------|---|
| | Green | Dry | N | P | K | | | |
| | (tons/acre) | | | | | | <u>Age 40</u> | |
| Overstory ¹ | 150.2 | 79.7 | 281.8 | 35.3 | 198.4 | 330.2 | 55.8 | 1304.0 |
| Foliage | 5.0 | 1.9 | 63.3 | 4.5 | 21.4 | 19.6 | 9.8 | 34.0 |
| Crown ² | 35.8 | 18.6 | 87.2 | 12.3 | 56.9 | 87.2 | 14.2 | 286.8 |
| Bole ³ | 109.4 | 59.2 | 131.3 | 18.5 | 120.1 | 223.4 | 31.8 | 983.2 |
| Saplings ⁴ | 27.3 | 14.4 | 49.1 | 6.2 | 38.4 | 57.2 | 12.6 | 288.7 |
| Aboveground | | | | | | | | |
| Tree Total | 177.5 | 94.1 | 330.9 | 41.5 | 236.8 | 387.4 | 68.4 | 1592.7 |
| Subordinate | | | | | | | | |
| Vegetation | 0.7 | 0.3 | 4.5 | 0.9 | 2.7 | 2.7 | 0.9 | 3.2 |
| Forest Floor | - | 1.6 | 33.0 | 2.7 | 2.7 | 6.2 | 1.8 | 135.5 |
| Soil ⁵ | - | - | - | 17.8 | 78.5 | 1498.6 | 183.8 | - |
| | | | | | | | <u>Age 60</u> | |
| Overstory ¹ | 259.6 | 129.0 | 388.9 | 42.6 | 216.1 | 404.4 | 131.8 | 2201.5 |
| Foliage | 5.3 | 1.9 | 49.3 | 3.1 | 12.3 | 26.2 | 16.9 | 35.0 |
| Crown ² | 41.6 | 21.5 | 115.3 | 11.7 | 53.1 | 125.2 | 29.7 | 365.8 |
| Bole ³ | 212.7 | 105.6 | 224.3 | 27.8 | 150.7 | 253.0 | 85.2 | 1800.7 |
| Saplings ⁴ | 7.8 | 4.3 | 15.7 | 1.0 | 5.9 | 20.7 | 3.9 | 71.6 |
| Aboveground | | | | | | | | |
| Tree Total | 267.4 | 133.3 | 404.6 | 43.6 | 222.0 | 425.1 | 135.7 | 2273.1 |
| Subordinate | | | | | | | | |
| Vegetation | 0.2 | 0.1 | 2.7 | 0.9 | 0.9 | 1.8 | 0.9 | 1.8 |
| Forest Floor | - | 1.4 | - | - | - | - | - | 20.2 |
| Soil ⁵ | - | - | - | 15.2 | 99.9 | 2377.2 | 322.9 | - |

1/ Trees \geq 5.0 inches DBH
 2/ All branches plus stem above 4" DOB top
 3/ Bole from stump to 4" DOB top

$\frac{4}{5}/$ Trees 1.0 to 4.9 inches DBH
 Available P and exchangeable K, Ca and Mg
 to 12" depth

Table 3s (continued)

| Component | Weight Green (tons/acre) | Dry | Nutrient Contents (lbs./acre) | | | | Higher Heating Values (BTU's/acre x 10 ⁶ /sq.ft.) |
|------------------------|--------------------------------|-------|----------------------------------|------|-------|--------|--|
| | | | N | P | K | Ca | |
| <u>Age 40</u> | | | | | | | |
| Overstory ¹ | 150.2 | 79.7 | 281.8 | 35.3 | 198.4 | 330.2 | 55.8 |
| Foliage | 5.0 | 1.9 | 63.3 | 4.5 | 21.4 | 19.6 | 9.8 |
| Crown ² | 35.8 | 18.6 | 87.2 | 12.3 | 56.9 | 87.2 | 14.2 |
| Bole ³ | 109.4 | 59.2 | 131.3 | 18.5 | 120.1 | 223.4 | 31.8 |
| Saplings ⁴ | 27.3 | 14.4 | 49.1 | 6.2 | 38.4 | 57.2 | 12.6 |
| Aboveground | | | | | | | |
| Tree Total | 177.5 | 94.1 | 330.9 | 41.5 | 236.8 | 387.4 | 68.4 |
| Subordinate | | | | | | | |
| Vegetation | 0.7 | 0.3 | 4.5 | 0.9 | 2.7 | 2.7 | 0.9 |
| Forest Floor | - | 1.6 | 33.0 | 2.7 | 2.7 | 6.2 | 1.8 |
| Soil ⁵ | - | - | - | 17.8 | 78.5 | 1498.6 | 183.8 |
| <u>Age 60</u> | | | | | | | |
| Overstory ¹ | 259.6 | 129.0 | 388.9 | 42.6 | 216.1 | 404.4 | 131.8 |
| Foliage | 5.3 | 1.9 | 49.3 | 3.1 | 12.3 | 26.2 | 16.9 |
| Crown ² | 41.6 | 21.5 | 115.3 | 11.7 | 53.1 | 125.2 | 29.7 |
| Bole ³ | 212.7 | 105.6 | 224.3 | 27.8 | 150.7 | 253.0 | 85.2 |
| Saplings ⁴ | 7.8 | 4.3 | 15.7 | 1.0 | 5.9 | 20.7 | 3.9 |
| Aboveground | | | | | | | |
| Tree Total | 267.4 | 133.3 | 404.6 | 43.6 | 222.0 | 425.1 | 135.7 |
| Subordinate | | | | | | | |
| Vegetation | 0.2 | 0.1 | 2.7 | 0.9 | 0.9 | 1.8 | 0.9 |
| Forest Floor | - | 1.4 | - | - | - | - | - |
| Soil ⁵ | - | - | - | 15.2 | 99.9 | 2377.2 | 322.9 |

¹/ Trees \geq 5.0 inches DBH
²/ All branches plus stem above 4" DOB top
³/ Bole from stump to 4" DOB top

⁴/ $\frac{4}{5}$ / Trees 1.0 to 4.9 inches DBH
⁵/ Available P and exchangeable K, Ca and Mg
 to 12" depth

Table 4 S Average green and dry weight, nutrient content and higher heating values per square foot of basal area of stand components in 10-, 20-, 40- and 60-year-old swamp site types

| Component | Weight | | | Nutrient Contents | | | Higher Heating Values | |
|------------------------|------------------------|----------------------|------|-------------------|------|------|-----------------------|-----------------------------------|
| | Green (tons/sq.ft.) | Dry (tons/sq.ft.) | N | P | K | Ca | Mg | (BTU's X 10 ⁶ /sq.ft.) |
| <u>Age 10</u> | | | | | | | | |
| Overstory ¹ | 0.48 | 0.23 | 1.23 | 0.60 | 0.73 | 0.93 | 0.60 | 4.1 |
| Foliage | 0.03 | 0.01 | 1.00 | 0.50 | 0.50 | 0.50 | 0.50 | 0.2 |
| Crown ² | 0.20 | 0.13 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.9 |
| Bole ³ | 0.25 | 0.10 | 0.20 | 0.10 | 0.20 | 0.40 | 0.10 | 3.1 |
| Saplings ⁴ | 0.42 | 0.21 | 0.98 | 0.10 | 0.85 | 1.16 | 0.26 | 3.5 |
| Total ⁵ | 0.42 | 0.21 | 0.99 | 0.12 | 0.84 | 1.15 | 0.27 | 3.5 |
| <u>Age 20</u> | | | | | | | | |
| Overstory ¹ | 0.78 | 0.42 | 1.61 | 0.16 | 0.81 | 3.06 | 0.51 | 7.0 |
| Foliage | 0.05 | 0.02 | 0.50 | 0.03 | 0.12 | 0.26 | 0.12 | 0.3 |
| Crown ² | 0.24 | 0.13 | 0.53 | 0.06 | 0.31 | 1.09 | 0.14 | 2.2 |
| Bole ³ | 0.49 | 0.27 | 0.58 | 0.08 | 0.38 | 1.71 | 0.25 | 4.5 |
| Saplings ⁴ | 0.59 | 0.33 | 1.53 | 0.14 | 0.80 | 2.74 | 0.28 | 5.5 |
| Total ⁵ | 0.64 | 0.35 | 1.55 | 0.15 | 0.80 | 2.81 | 2.34 | 5.9 |

1/ Trees \geq 5.0 inches DBH

2/ All branches plus stem above 4" DOB top

3/ Bole from stump to 4" DOB top

4/ Trees 1.0 to 4.9 inches DBH

5/ Trees \geq 1.0 inch DBH

Table 4_S (continued)

| Component | Weight | | Nutrient Contents | | | | (BTU's X 10 ⁶ /sq.ft.) |
|------------------------------|---|--|-------------------|------|------|------|-----------------------------------|
| | Green | Dry | N | P | K | Ca | |
| | (tons/sq.ft.) | | | | | | |
| <u>Age 40</u> | | | | | | | |
| Overstory ¹ | 0.87 | 0.46 | 1.64 | 0.21 | 1.15 | 1.92 | 0.32 |
| Foliage | 0.03 | 0.01 | 0.37 | 0.03 | 0.12 | 0.11 | 0.06 |
| Crown ² | 0.21 | 0.11 | 0.51 | 0.07 | 0.33 | 0.51 | 0.08 |
| Bole ³ | 0.64 | 0.34 | 0.76 | 0.11 | 0.70 | 1.20 | 0.18 |
| Saplings ⁴ | 0.53 | 0.03 | 0.94 | 0.12 | 0.74 | 7.45 | 1.32 |
| Total ⁵ | 0.79 | 0.42 | 1.48 | 0.19 | 1.06 | 1.73 | 0.31 |
| <u>Age 60</u> | | | | | | | |
| Overstory ¹ | 0.93 | 0.46 | 1.39 | 0.15 | 0.77 | 1.45 | 0.47 |
| Foliage | 0.02 | 0.01 | 0.18 | 0.01 | 0.04 | 0.09 | 0.06 |
| Crown ² | 0.15 | 0.08 | 0.41 | 0.04 | 0.19 | 0.45 | 0.11 |
| Bole ³ | 0.76 | 0.38 | 0.80 | 0.10 | 0.54 | 0.91 | 0.31 |
| Saplings ⁴ | 0.60 | 0.33 | 1.21 | 0.08 | 0.45 | 1.59 | 0.30 |
| Total ⁵ | 0.92 | 0.46 | 1.39 | 0.15 | 0.76 | 1.46 | 0.46 |
| <u>Higher Heating Values</u> | | | | | | | |
| 1/ | Trees \geq 5.0 inches DBH | <u>4/ Trees 1.0 to 4.9 inches DBH</u> | | | | | |
| 2/ | All branches plus stem above 4" DOB top | <u>5/ Trees \geq 1.0 inch DBH</u> | | | | | |
| 3/ | Bole from stump to 4" DOB top | | | | | | |